

## Claims

1. A vehicular rotating electrical machine apparatus comprising:

a rotating electrical machine including a shaft rotatably supported by a pair of brackets having a suction hole at an end face and an exhaust hole at an outer periphery, a rotor disposed in the pair of brackets, fixed to the shaft, having a field winding mounted to an inside, and having cooling fans mounted to both end faces, and an armature fixed to the pair of brackets at an outer periphery of the rotor to surround the rotor and including an armature iron core on which an armature winding is wound, and

an inverter unit which converts DC power of a battery into AC power, supplies the AC power to the armature winding and causes the rotor to generate rotating power, or converts AC power generated in the armature winding into DC power and charges the battery,

in which the inverter unit has a substantially hollow cylindrical shape or hollow polygonal prism shape, and includes a heat sink having many heat radiating fins at least part of an outer surface, and

the inverter unit surrounds the shaft at an anti-load side end of the rotating electrical machine, and is disposed to cause cooling air by the cooling fan to cool the heat radiating fins before cooling of the rotating electrical

machine.

2. A vehicular rotating electrical machine apparatus according to claim 1, characterized in that the inverter unit includes the heat sink having the many heat radiating fins made of metal material at least one place of an inner peripheral surface, an anti-bracket side end face, and an outer peripheral surface, is integrally fixed to an outside end face of one of the pair of brackets, and is covered by a cover provided with a suction hole at an end face in an axial direction, and

the inverter unit is disposed to cause the cooling air sucked by the cooling fan through the suction hole of the end face of the cover in the axial direction to cool the heat radiating fins before cooling of the rotating electrical machine.

3. A vehicular rotating electrical machine apparatus according to claim 1, characterized in that the inverter unit includes the heat sink having the many heat radiating fins made of metal material at least one place of a bracket side end face and an outer peripheral surface, is integrally fixed to an outside end face of one of the pair of brackets, and is covered by a cover provided with many suction holes at an outer peripheral surface, and

the inverter unit is disposed to cause the cooling air sucked by the cooling fan through the suction holes of the outer peripheral surface of the cover to cool the heat radiating fins

before cooling of the rotating electrical machine.

4. A vehicular rotating electrical machine apparatus according to claim 3, characterized in that part of or all of the heat radiating fins are radially disposed substantially toward a center direction.

5. A vehicular rotating electrical machine apparatus according to claim 3, characterized in that part of or all of the heat radiating fins are disposed substantially in parallel to the shaft and to expand radially from a center direction.

6. A vehicular rotating electrical machine apparatus according to any one of claims 3 to 5, characterized in that a partition wall or an air-guide wall to control an exhaust direction is provided to the cover or the bracket to which the inverter unit is fixed, so that high temperature exhaust cooling air exhausted from the exhaust hole provided in the outer periphery of the bracket is not circulated to and sucked through the suction hole of the cover.

7. A vehicular rotating electrical machine apparatus according to any one of claims 2 to 6, characterized in that raw material of the cover is metal.

8. A vehicular rotating electrical machine apparatus according to claim 1, characterized in that the inverter unit includes the heat sink having the many heat radiating fins made of metal material at least one place of an inner peripheral surface, a bracket side end face, and an outer peripheral

surface, and is integrally fixed to an inside end face of one of the pair of brackets, and

the rotor and the armature are partitioned by a substantially donut-shaped partition plate with a through hole at a center, and the inverter unit is disposed to cause the cooling air sucked through the suction hole of the end face of the bracket in an axial direction by the cooling fan to cool the heat radiating fins before cooling of the rotating electrical machine.

9. A vehicular rotating electrical machine apparatus according to claim 8, characterized in that the partition plate is integrally fixed to the inverter unit.

10. A vehicular rotating electrical machine apparatus according to any one of claims 1 to 9, characterized in that the inverter unit includes an inverter module including plural switching elements.

11. A vehicular rotating electrical machine apparatus according to any one of claims 1 to 9, characterized in that the inverter unit includes an inverter module including plural switching elements and a capacitor connected in parallel to the inverter module.

12. A vehicular rotating electrical machine apparatus according to any one of claims 1 to 9, characterized in that the inverter unit includes an inverter module including plural switching elements, a capacitor connected in parallel to the

inverter module, and a control device to control switching operations of the plural switching elements.

13. A vehicular rotating electrical machine apparatus according to any one of claims 1 to 9, characterized in that the inverter unit includes an inverter module including plural switching elements, a capacitor connected in parallel to the inverter module, a field current control device to control field current, and a control device to control switching operations of the plural switching elements.

14. A vehicular rotating electrical machine apparatus according to any one of claims 10 to 13, characterized in that the inverter unit including the heat sink part is arranged to be divided into plural parts in a circumferential direction or an axial direction.

15. A vehicular rotating electrical machine apparatus according to any one of claims 10 to 14, characterized in that the switching elements includes SiC-MOSFETs using SiC composition material.

16. A vehicular rotating electrical machine apparatus according to any one of claims 10 to 14, characterized in that the switching elements include SiC-SITs using SiC composition material.

17. A vehicular rotating electrical machine apparatus according to any one of claims 1 to 16, characterized in that the rotor includes

a rotor iron core including a magnetic pole part formed into a claw-pole type in which adjacent magnetic poles are different from each other and a cylindrical part having the field winding, and

a permanent magnet which is provided in a magnetic circuit of the rotor iron core and supplies, together with the field winding, a magnetic flux to the armature iron core.